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**Growth Dislocations in Zinc Oxide Crystals**

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Beamline(s): X19C

**Introduction**: Zinc oxide (ZnO) is a wide band-gap semiconductor with an energy gap of 3.37 eV with potential for applications as emitter devices in the blue to ultraviolet region and as a substrate material for GaN based devices [1]. Crystalline perfection is studied using synchrotron white beam x-ray topography.

**Methods and Materials**: ZnO crystals have been grown using platinum lined high strength steel autoclaves at 355°C with temperature differential of 10°C. The mineralizer solution was made of $Li_2CO_3$, KOH and NaOH. The nutrient was prepared from 99.99% ZnO. Crystal growth was carried out on (0001) cut seed plate. Crystal plates of $(10\bar{1}0)$ ZnO cut perpendicular to the seed were polished. The crystal sample was mounted on a goniometer and was aligned using back reflection Laue diffraction. Topographs of different reflections were recorded by scanning in white beam synchrotron radiation.

**Results**: Topograph in Figure 1 shows the general dislocation features characteristic of solution grown crystals. The boundary between seed and the bulk grown on the seed is clearly seen. Large numbers of dislocations are running approximately normal to the 'c' face. They also show the refraction while crossing the growth sector boundaries. Almost all dislocations present in the seed propagate into the bulk along 'c' direction. Less number of dislocations propagate perpendicular to prism planes. Also growth sector boundaries as well as the growth rate variation along +C and –C direction can be seen. It was interesting to note that these dislocations of edge character. These dislocations extinguish in the topograph of (0001) reflection.

**Conclusions**: The topograph taken on $(10\bar{1}0)$ slice containing the seed shows complete growth history. The dislocations present in the seed propagated into the bulk. Interestingly these dislocations are found to be of edge character possibly contributing in crystal growth phenomena.

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**References**:

[1] D.M. Bagnall, Y.F. Chen, Z. Zhu, T. Yao, M.Y. Shen, and T. Gato, Appl. Phys. Lett**. 73** (1998) 1033

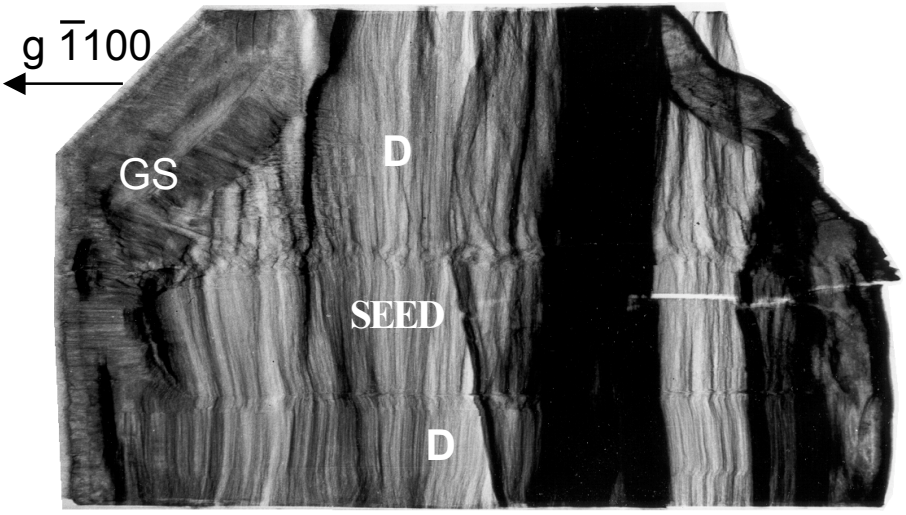


**Figure 1**. Topograph of $(10\bar{1}0)$ slice containing the seed and the grown bulk revealing the dislocations and the growth history. GS – Growth sector boundary; D – Dislocations